yet when subjected to the test of time it is utterly impracticable; witness the McCallum bridge carrying the Northern Central Railway over the Susquehanna River above Harrisburg, which has just been replaced by an Improved Howe.

Next to the Howe, and in many particulars superior to it, is the Whipple Truss, a modification of the Pratt (Fig. 10), which we have seen is but a substitution of the diagonal rod and vertical post, for the vertical rod and diagonal brace of the Howe. The practical advantages possessed by this truss over the Howe, consist for the most part in a saving of material over the piers in case of a through bridge, and in the first two panels beyond the pier in the case of a deck bridge; there are also some minor advantages in the connection of the posts and rods with the chords, but the important fact remains the same, that the end rods and braces must sustain the entire load upon the truss, and of course the same difficulties as were experienced in the Howe truss for long spans may be expected in the Whipple. Other systems might be mentioned, presenting many points of interest to the practical observer, but as the two already noted cover as much ground and are probably better understood than any other systems in general use, we shall not weary the reader with further examinations. Both these trusses involve diagonal and vertical members in their web, and consequently are compelled to furnish and carry much additional material above what is absolutely required in the transmission of the load to the points of support, if effected by the most economical lines; and no amount of perfection in workmanship or ingenious appliances can by any possibility remove the defect, since it is inherent in the general design and must continue as a characteristic of the structures.

Again, we have seen that the limiting span in each of the above systems is about the same; and here let it be thoroughly understood that the term limiting span in this connection, is not intended to apply to the theoretical limit to which a wooden girder of either pattern may be built, but the practical limit beyond which the ordinary sizes of